Terra/Aqua MODIS Fire Product Continuity Sentinel-3 Pilot Study Update

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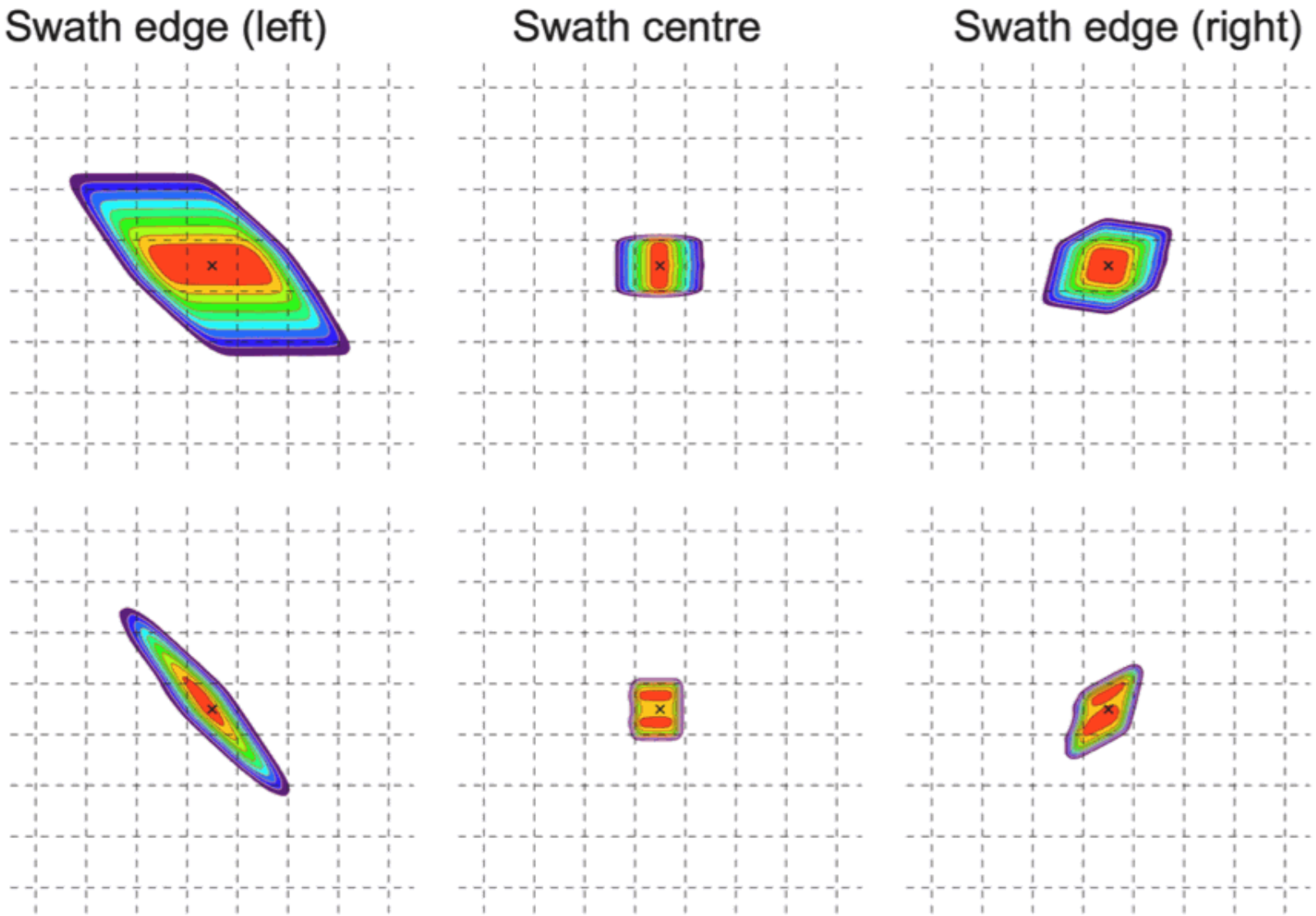
Sentinel-3A/3B SLSTR

- ESA Sentinel-3A (Feb. 2016 launch) + Sentinel-3B (Apr. 2018 launch)
- 10:00 local crossing time (sun-synchronous orbit)
- Sea and Land Surface Temperature Radiometer (SLSTR)
  - 1420-km swath (versus 2300-km MODIS swath)
  - Oblique + nadir asymmetric conical scans
  - 1-km fire bands
  - Quirks w/ respect to saturation and band-to-band co-registration
- Near-real time (NRT) and science-quality SLSTR active fire products available from EUMETSAT and ESA, respectively
  - Our focus is on SLSTR NRT active fire product for FIRMS

Summary of SLSTR Active-Fire Product Findings (1/2)

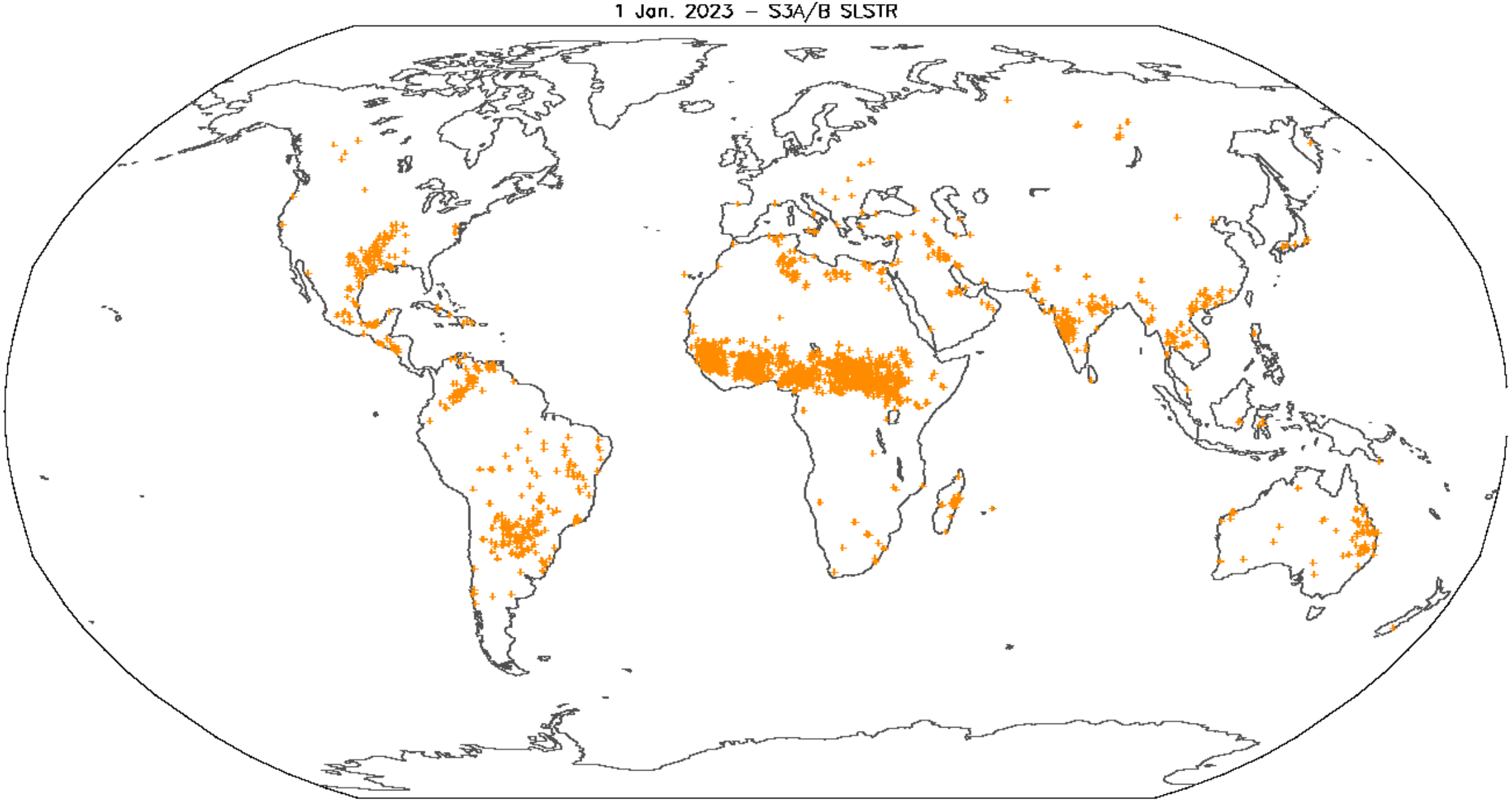
- Sentinel-3 NRT & standard fire products are two distinctive processing branches due to the different European Commission mandates
  - No requirement for NRT and standard products to be aligned
- NRT product actually contains four different active-fire products made with four different detection algorithms
- Each SLSTR reports ~3× as many fire pixels as Terra MODIS
  - Higher sensitivity, especially at night
    - Constrained pixel growth + wavelength
  - Higher false alarm rate, especially along cloud edges
    - MWIR/LWIR misregistration + wavelength
- Significant differences in distribution of fire radiative power (FRP)

SLSTR Pixel Footprint



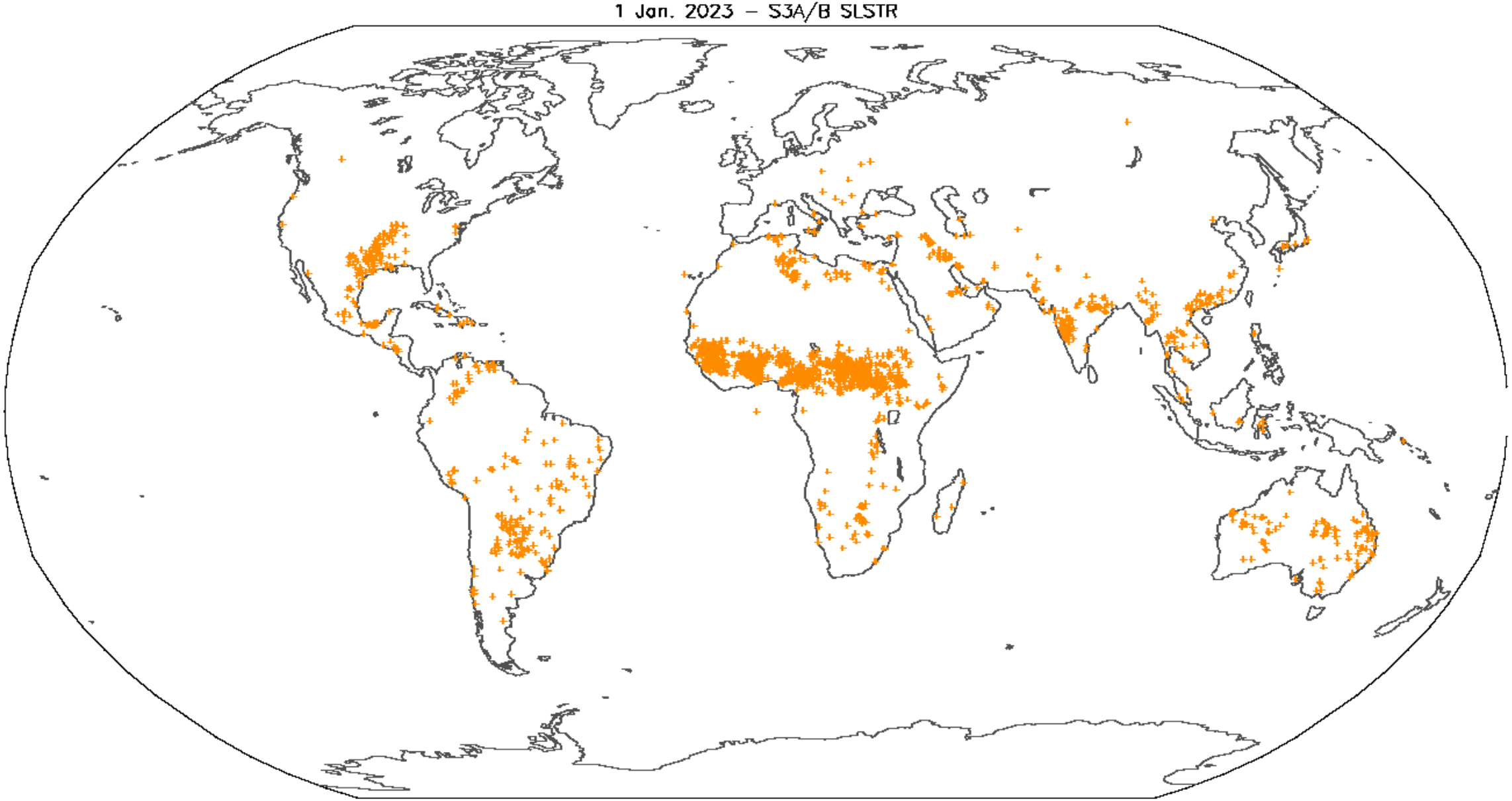
Xu et al. (2021, RSE)

1 Jan. 2023 **S3A+S3B SLSTR ESA Algorithm #1 (Science Product)** **16,061 fire pixels**



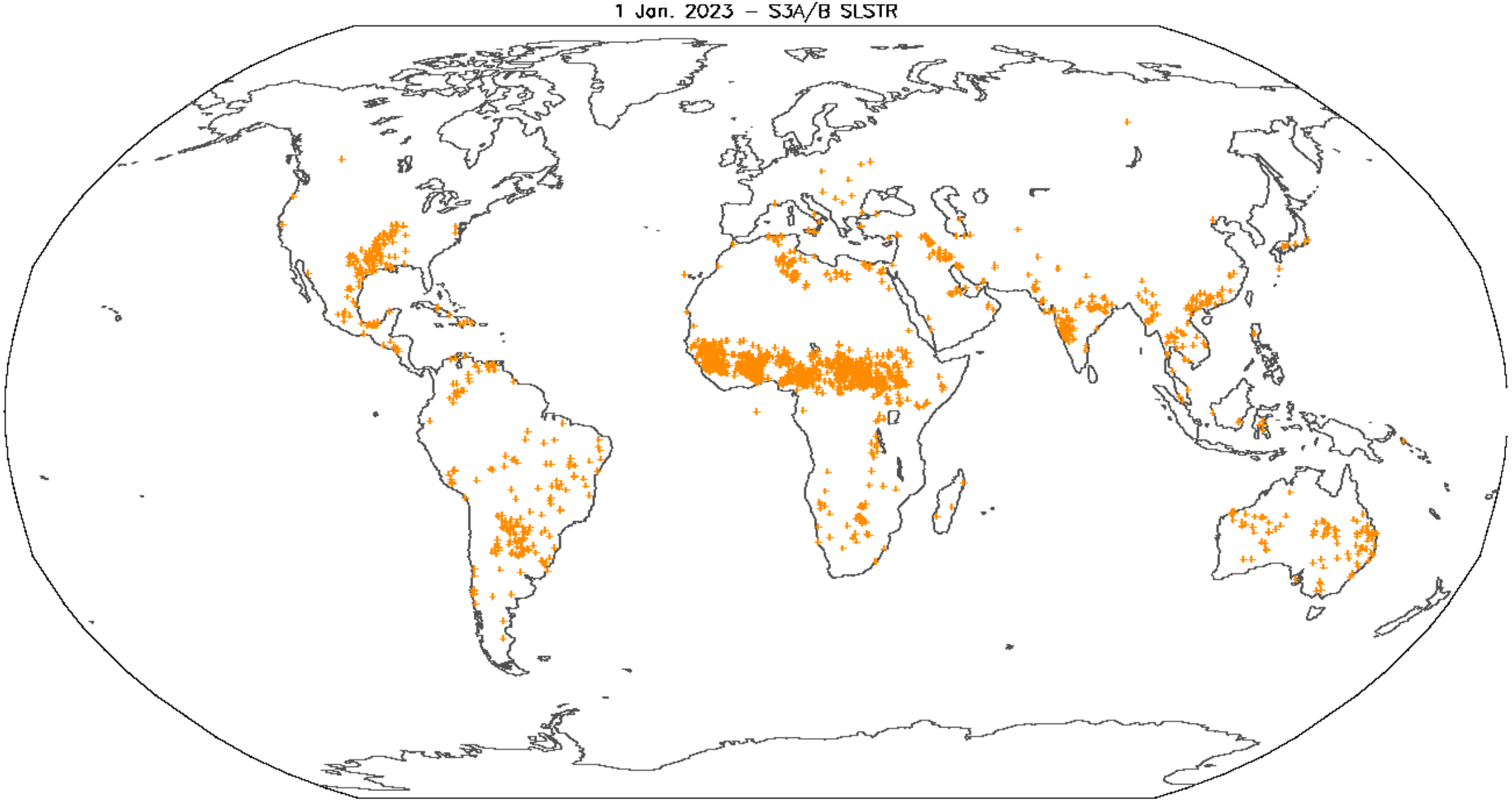
1 Jan. 2023 **S3A+S3B SLSTR EUMETSAT NRT Algorithm #2**

12,242 fire pixels



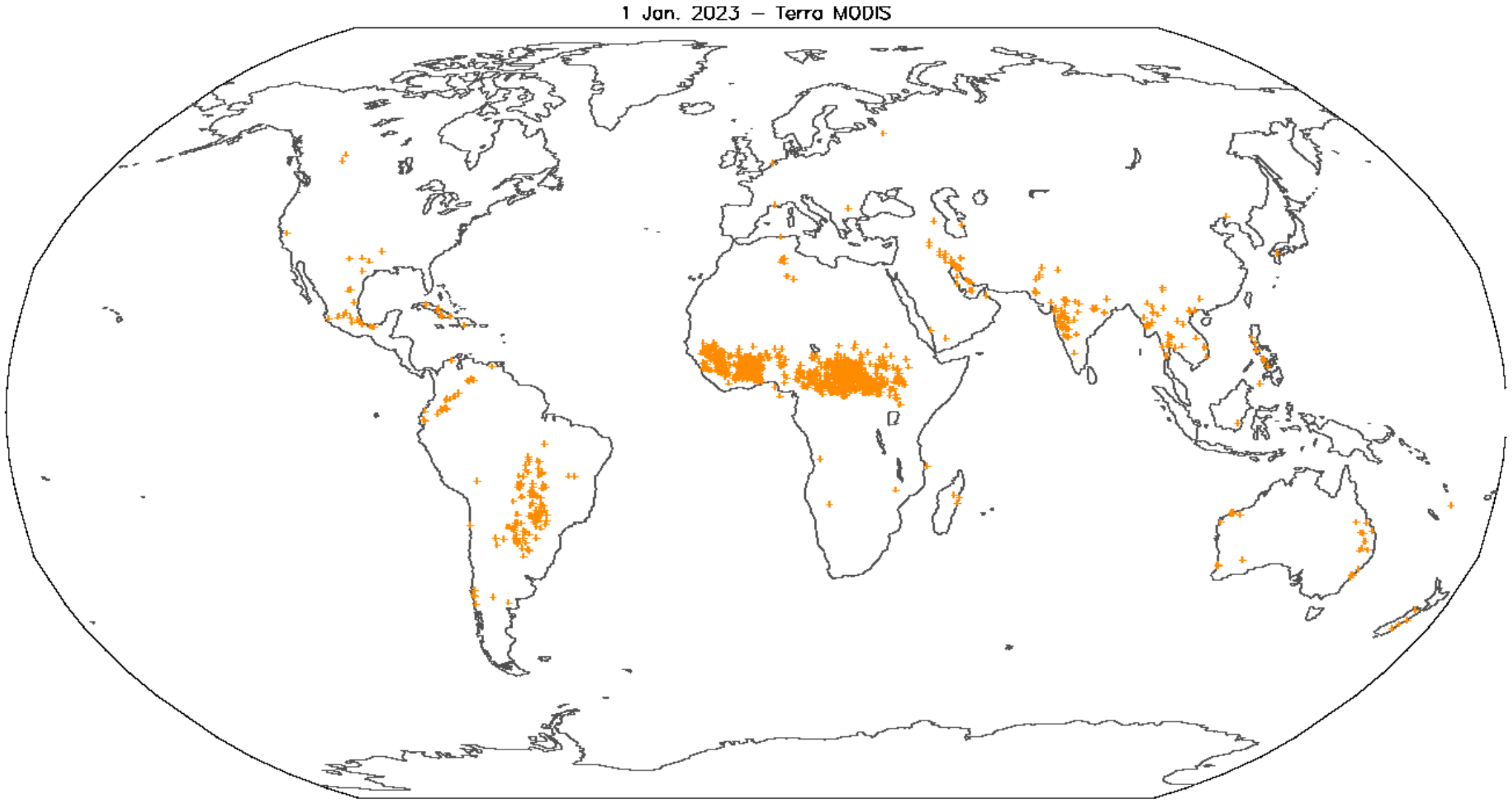
1 Jan. 2023 **S3A+S3B SLSTR EUMETSAT NRT Algorithm #3**

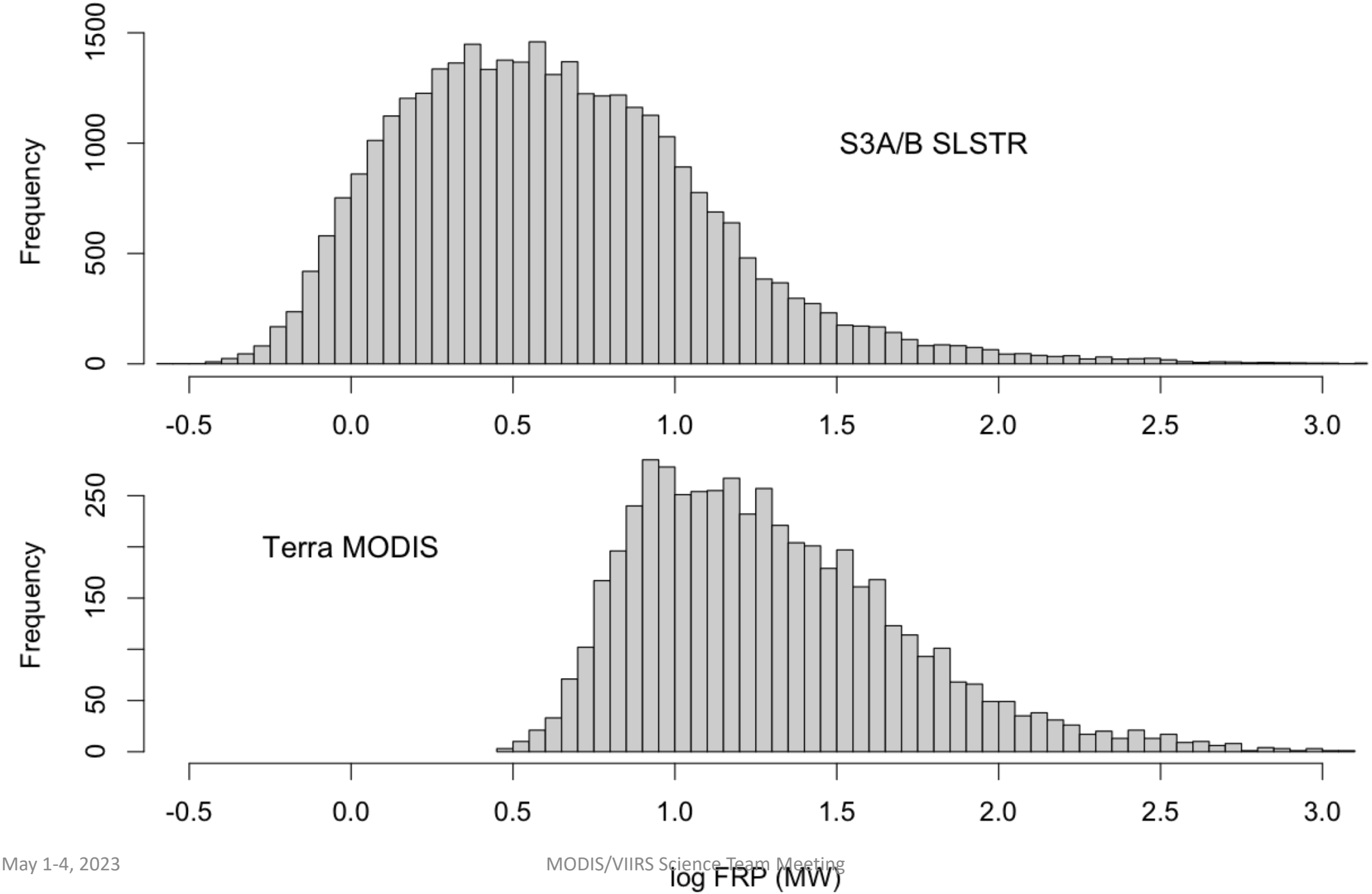
7,098 fire pixels



1 Jan. 2023 **Terra MODIS**

3,134 fire pixels




S3A/B SLSTR
Frequency
0
500
1000
1500
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Terra MODIS
Frequency
0
50
150
250
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
log FRP (MW)

Summary of SLSTR Active-Fire Product Findings (2/2)

- Assorted practical (but mostly manageable) product issues
  - Cumbersome product format (zip files)
  - Product size is many times larger than MODIS swath product
  - Significant differences in contents of standard vs. NRT products
  - Most/all production software is proprietary
- NRT fire product is not yet widely used but is actively being updated by EUMETSAT
  - Numerous recommendations from our team
- Continuing false-alarm assessment with eye toward filtering in FIRMS